ENERGY STAR Connected Thermostats Grid Responsiveness Proposal for Draft Version 1.0

Stakeholder Webinar and Discussion

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Agenda

- Welcome & Introduction
- What is ENERGY STAR?
- Background – ENERGY STAR Connected
- Grid Responsiveness Criteria
- Test Method
- Q&A

ENERGY STAR

For more than 20 years, EPA's ENERGY STAR program has identified

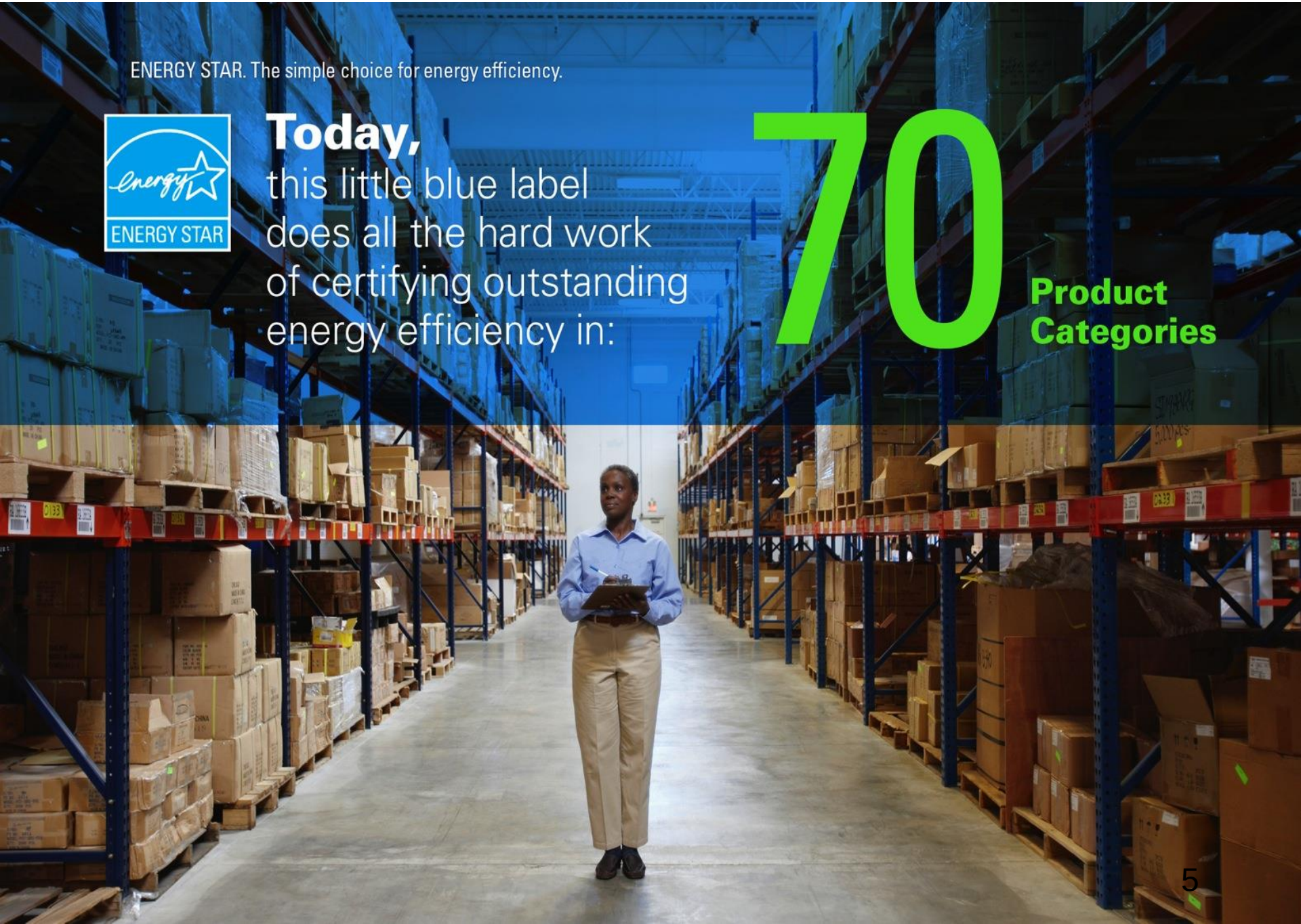
the most energy efficient products, buildings, plants, and new homes –

all based on the latest government-backed standards and now a rigorous third-party certification process.

ENERGY STAR Program Overview

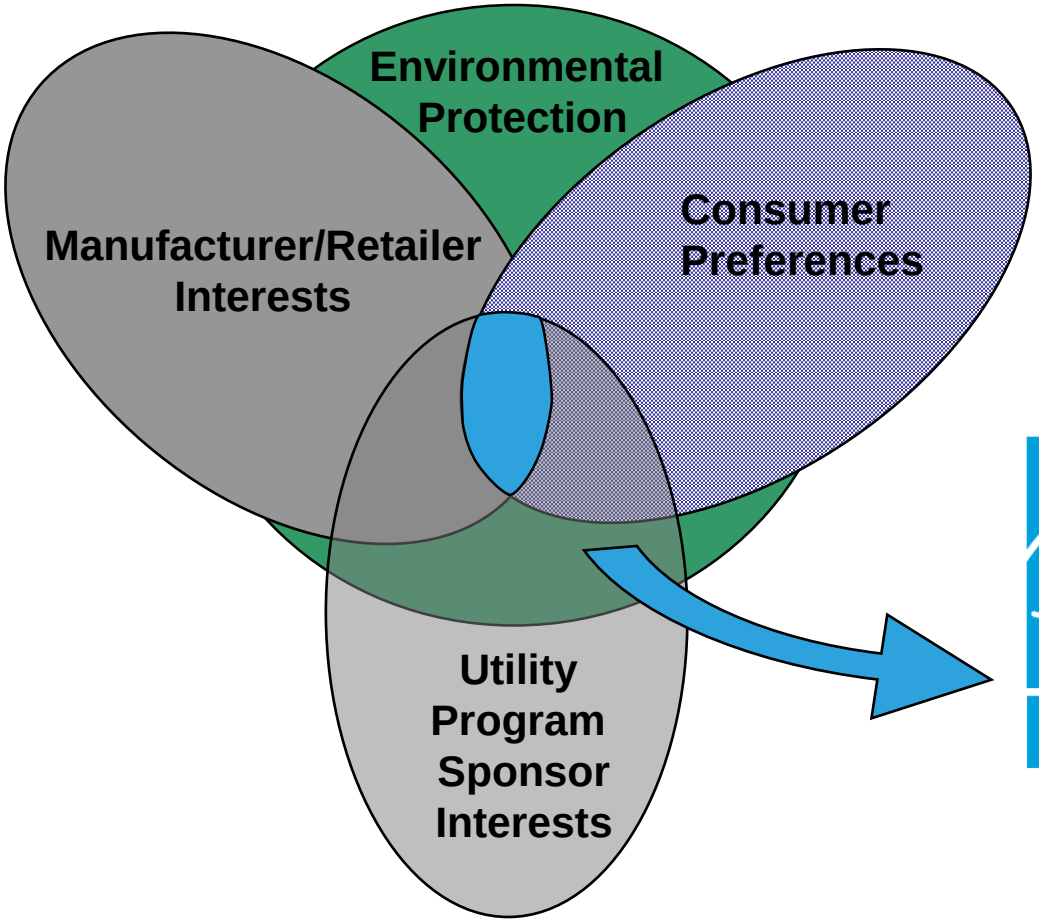
ENERGY STAR® is the simple choice for energy efficiency. For more than 20 years, EPA's ENERGY STAR program has been America's resource for saving energy and protecting the environment.

From 1993 to 2013 Americans have purchased more than 300 million products that earned the ENERGY STAR across **more than 70 product categories**. That's more than 4.8 billion products, about 58 million vehicles off the road, and **$30 billion saved!**


ENERGY STAR. The simple choice for energy efficiency.
ENERGY STAR
Today,
this little blue label
does all the hard work
of certifying outstanding
energy efficiency in:
70
Product
Categories


Every single day,
consumers choose
ENERGY STAR
products more than
800,000 times

ENERGY STAR's Focus



- Cost-effective
- No Sacrifice in Performance
- Government -backed

Consumer is Key

Specification Development Cycle

Important Process Elements

- Consistency
- Transparency
- Inclusiveness
- Responsiveness
- Clarity

Background - ENERGY STAR Connected Functionality (CF)

– ENERGY STAR Product categories with optional, additional recognition for CF:

- Refrigerators
- Clothes Washers
- Clothes Dryers
- Lighting
- Room Air Conditioners
- Residential Dishwashers
- Pool Pumps
- Electric Vehicle Supply Equipment (under development)

Background - EPA Approach to Connected Functionality (CF)

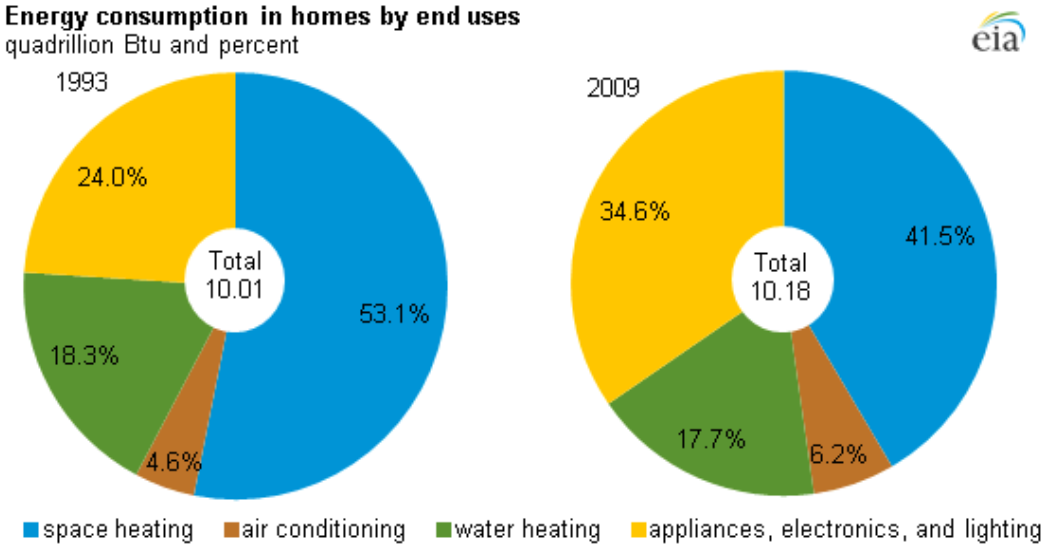
- Appliance CF criteria includes:
  - Open Standards & Open Access
  - Energy Consumption Reporting
  - Remote Management
  - Operational Status Reporting
  - Demand Response
    - ≥ 4 hours - moderate load shed
    - ≥ 10 minutes – deep load shed

Connected Thermostats – Mandatory Grid Responsiveness – Why?

- Consistency – grid responsiveness is included for all ENERGY STAR product categories with Connected functionality
- Connectivity is required for connected thermostats in order to assure consumers of savings – as previously discussed, presence of enabling control in home does not necessarily lead to energy savings.
- Utility interest in grid responsive thermostats provides an opportunity to get energy saving devices into consumers' homes.

Grid responsiveness opportunity for connected Thermostats

- Residential Space heating at 41.5%, is the largest portion of residential energy use (EIA 2009 RECS survey)
- Summer Peak Loading dominated by residential A/C usage



Proposed CT Grid Responsiveness Criteria

- Key Factors:
  - Builds on connected criteria for other ENERGY STAR products, but
  - Crafted to capture the unique opportunities for residential space conditioning
  - Streamlined approach:
    - Open standards / open access connectivity
    - Demand Response
    - Price Response
- Drivers:
  - enable grid benefits,
  - enable price responsiveness, while
  - protecting consumers from severe comfort impacts

Communications Criteria

- Use of Open Standards
  - for all communication layers
  - applicable to communications:
    - to/from the CT device (preferred), or
    - to/from an off premise service
- Open Access – API available
- Driver – enable utilities and interested 3rd parties to leverage CT Grid Responsiveness criteria

Demand Response – Type 1

- Default response – setpoint offset of:
  - +4°F cooling
  - - 4°F heating
- Response maintained:
  - until the end of the requested period, or
  - for at least 4-hours
- Additional responses & configurability of responses encouraged
- Key use case – planned (day ahead) load dispatch

Demand Response – Type 2

- Default response – suspend HVAC operation, excepting:
  - conventional heating sources (typically oil or gas)
  - system fan, circulating pump (for hydronic systems), and the like
- Response maintained:
  - until the end of the requested period, or
  - for at least 10-minutes
- Key use case – spinning reserves, fast-response load shed

Demand Response – Conflict Resolution

- Type 2 DR takes precedence over Type 1
  - Case 1, Type 2 signal received while CT is in a Type 1 response – CT cancels & terminates its Type 1 response and initiates Type 2 response
  - Case 2, Type 1 signal received while CT is in a Type 2 response – CT completes its Type 2 response
- Driver – Type 2 responses are of high economic value and/or are called in emergencies

Demand Response – Exceptions & Override

- Protect consumers from room temps, <50°F or >85°F
- CT not required to respond to:
  - > one Type 1 signal per rolling 24 hour period,
  - > three Type 2 signals per rolling 24 hour period, or
  - > one Type 2 signal per hour
- Consumers can always override:
  - Type 1 override – CT is not required to respond to subsequent Type 1 signals for 24-hours
  - Type 2 override – CT is not required to respond to subsequent Type 1 or Type 2 signals for 1-hour
- Driver – enable consumers to remain in control

Demand Response – Data From the CT

- Signal Types
  - ACK - current operating status & planned load shed
  - RT_{pre} – HVAC run time in the preceding hour
  - RT_{shed} – HVAC run time during the response period
  - RT_{post} – HVAC run time in the subsequent hour
  - Override – time of customer override
- Drivers:
  - inform availability of dispatch-able load
  - enable M&V of load shed
  - minimize consumer privacy impacts

Price Response

- Notify consumers of changing energy prices
- Capability to intelligently control/manage HVAC load under time-varying energy prices

Price Response – Use Cases

- Allow consumers to effectively manage their HVAC energy use under variable price programs:
  - Price aware CT automatically reduces HVAC operating costs in accordance with consumer settings
  - CT integration into an EMS that provides central, price-responsive control of energy sources, storage, and loads
  - Utility price response programs

Test Method

- EPA intends to release a draft test method along with the Draft 2 V1.0 CT specification.
- Test methodology will cover:
  - CT device criteria, including standby energy use
  - Field savings assessment (for semi-annual reporting)
  - Grid Responsiveness

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